ONTARIO

Water Quality Evaluation
of
Confederation Lake
District of Kenora
1970

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WATER QUALITY EVALUATION

of

CONFEDERATION LAKE

District of Kenora

1970

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SUMMARY

On June 17 and July 14, 1970, staff of the Biology Branch undertook pre-operational surveys on Confederation Lake in the vicinity of a proposed mining development.

Based on the results of these two surveys, the physico-chemical and biological conditions present in Confederation Lake indicate that the lake is on the border between oligotrophy and mesotrophy.

In order to protect the excellent quality of Confederation Lake for the greatest number of beneficial uses. treatment of wastes from the proposed mining and milling development should be adequate to satisfy the Commission's water quality criteria for the protection of fish and wildlife, particularly those criteria which pertain to toxic substances and pH.

The report lists specific water quality criteria necessary to protect the aquatic life of Confederation Lake. The stringent nature of these criteria demonstrate the necessity for maximum possible reuse of process water. The water quality criteria cited in this report should be applied at a selected monitoring site and owing to the conservative nature of metals and dissolved solids, a consideration of the loading volume relative to the water volume and throughput characteristics of Confederation Lake is essential. These assessments will ensure the future protection of the receiving waters from accumulations of these constituents to sub-lethal levels affecting fish production.

INTRODUCTION

A survey of Confederation Lake located in the District of Kenora was carried out on June 17 and repeated on July 14, 1970, in order to document natural physical, chemical and biological characteristics of the lake prior to the commencement of base-metal extracting and milling operations by South Bay Mines Limited on their Dent Township property.

Findings of this survey, as reported herein, will provide the basis for evaluating subsequent changes in water quality should they occur as a result of the proposed land-use.

GENERAL DESCRIPTION OF THE STUDY AREA

Confederation Lake is located some fifty miles to the northeast of Ear Falls in the geographic townships of Dent and Mitchell, District of Kenora. The lake is accessible via secondary highway from Ear Falls.

Confederation Lake occupies roughly 10,300 acres of glacial basin and has a maximum depth of 106 feet. Its drainage which is disorganized due to glacial action is to the north and eventually joins up with the English River to the southwest. The lake is dotted with numerous islands and surrounded by gently rolling terrain with a mixed forest cover of black spruce, jack pine, white birch and poplar. Soil cover in the area is basically shallow deposits of sandy clay over Precambrian bedrock.

Owing to the lack of land access to the lake prior to 1970, the lake has remained, for the most part, in its natural state. One tourist camp is located on the South Bay portion of the lake to the south west of the proposed mining development. Because of the splendid aesthetic features of Confederation Lake and its northern pike and lake trout, the lake has excellent potential for recreational activities. At the present time, the lake supports a limited commercial fishery for whitefish and lake trout.

NATURE OF PROPOSED MINING DEVELOPMENT

During 1969, Selco Mining and Development Limited made known its decision to proceed with the development of mining and milling facilities at the site of its Dent Township holdings. The operation under the control of a new subsidiary, South Bay Mines Limited, was to commence production during the first quarter of 1971 with a milling capacity of 500 tons per day and a life expectancy of from 4 to 10 years. The orebody which is predominantly pyrite (FeS_2), sphalerite (AnS) and chalcopyrite ($CuFeS_2$) is to be mined by conventional underground extraction techniques.

Wastewaters generated by mining and milling of sulphuritic ores are a serious source of contaminants which if improperly handled, could disrupt or destroy the ecological balance of Confederation Lake. One of the most serious potential effects of mining and milling wastes in the aquatic environment is the generation of acid resulting from the oxidation of gangue sulphide. A simplified version of the reaction is as follows:

$$4\ FeS_2 + 15\ O_2 + 14\ H_2O \longrightarrow 4\ Fe(OH)_3 + 16H^+ + 8SO_4^{-2}$$

Hydrogen ions liberated by this reaction could lower the pH of the receiving water which in turn would seriously affect the aquatic community. In addition to acid generation, mill wastes are characteristically high in dissolved solids, especially sulphates, and contain heavy metals which could have harmful osmotic and/or toxic effects on aquatic organisms, including fish.

The proposed method of handling wastes by South Bay Mines Limited is to utilize a 50-acre depression immediately north of Boomerang Lake. Where necessary to prevent the escape of tailings from the disposal area, containment walls and/or seepage basins are to be provided. During the early phase of production, tests are to be carried out to determine the feasibility of utilizing a recycle system to return supernatant water from the impoundment area back to the milling circuit, so that no liquid wastes will decant to Confederation Lake. If the recycle system proves to be unworkable and wastewater then has to be discharged to a watercourse, the necessary treatment facilities will be provided to ensure compliance with OWRC objectives.

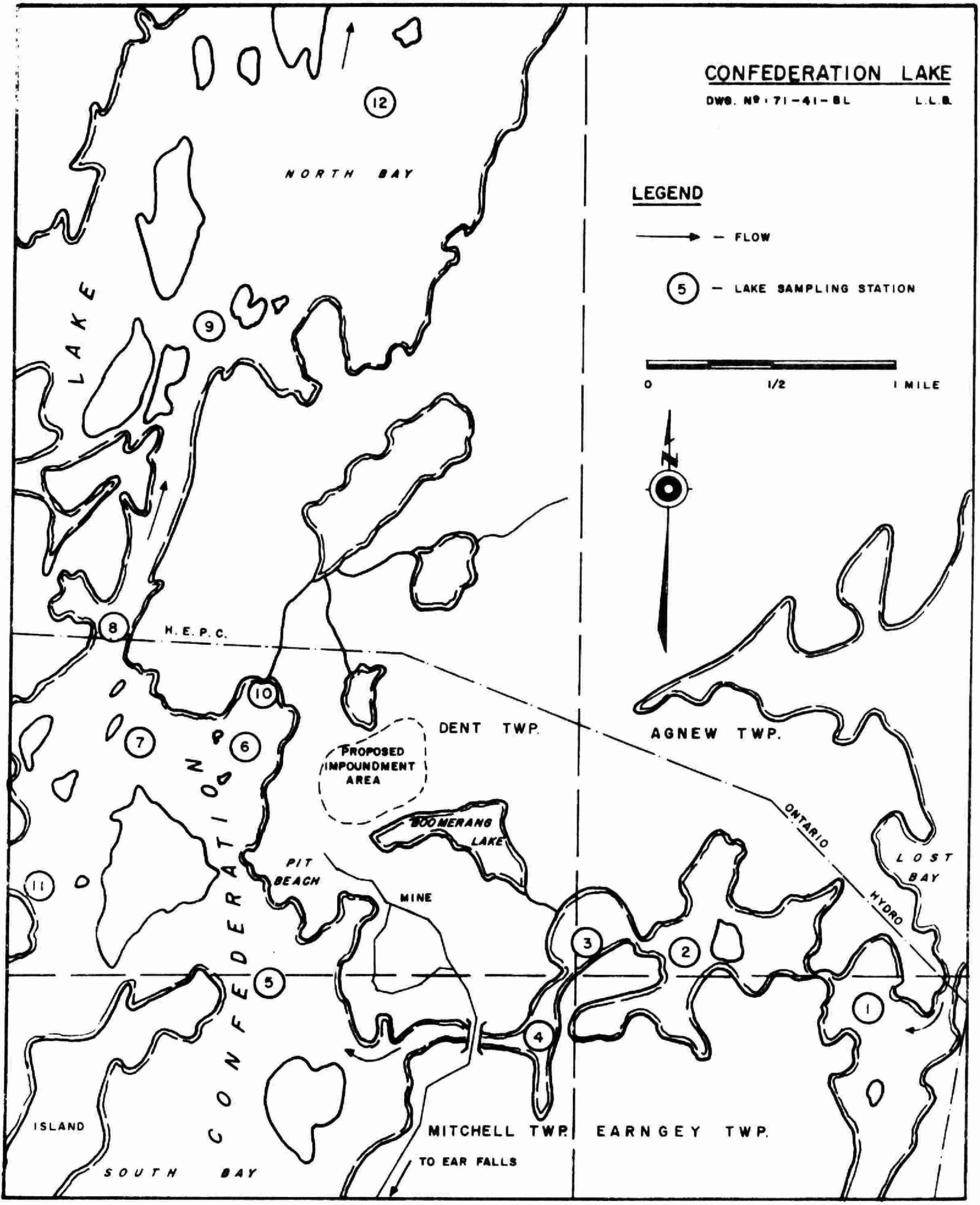
METHODS

The data reported herein was produced from visits to the study area on June 17 and July 14, 1970. At the time of the June sampling, it was understood that Boomerang Lake was to be used as the tailings area and the sampling points were selected accordingly. By the time of the July sampling, the tailings impoundment site had been changed and a few of the original points were dropped in favour of new ones which would be more useful in monitoring the areas likely to be influenced by discharges from the new site. On June 17, sampling was carried out at stations 1 to 9 as illustrated in Figure 1. Sampling on July 14 was undertaken at station 2 and at stations 4 to 12, inclusive.

Sampling at stations 4, 6 and 9 were carried out at ten foot intervals from surface to bottom. With exceptions of stations 3 and 10, which were shallow in nature and sampled only at the surface, the remaining stations were each sampled at surface and bottom.

On-the-spot measurements of water transparency, temperature, pH, dissolved oxygen and specific conductivity were taken at each sampling site. Water transparency was measured with an eight inch Secchi disc. Temperature readings were made using a telethermometer. Dissolved oxygen concentrations were determined using the azide modification of the Winkler method. pH and conductivity measurements were read from field meters.

Water samples for detailed chemical analyses were secured with a Kemmerer water sampler. Analyses for heavy metals were made on samples collected in plastic containers and preserved with nitric acid at the time of sampling. All other chemical determinations were carried out on unpreserved samples shipped in glass containers. All chemical analyses on water samples were conducted at OWRC laboratories.



CONFEDERATION LAKE

DWG. Nº 71-41-BL L.L.B.

Samples for bacterial analyses were taken from surface only and shipped in sterilized glass containers for laboratory examination.

Composite phytoplankton samples were taken from the euphotic zone at each of the sampling locations. The euphotic zone was determined as twice the Secchi disc reading. Samples for phytoplankton analyses were preserved with Lugol's iodine and submitted to the OWRC laboratory at Toronto for identification and enumeration.

Bottom fauna samples were secured on July 14, from sampling station 2 and stations 4 to 12 inclusive. Three bottom fauna samples were secured at 2 and 4, ten samples were taken at station 6 and five samples secured at each of the remaining stations.

The bottom fauna samples were secured by means of a 9 x 9 inch Ekman dredge. Dredge samples were washed through a 24-mesh-per-inch (0.0256 inch opening) seive and the organisms were separated and removed from extraneous materials. The specimens were then preserved in ethanol and sent to the laboratory for identification and enumeration.

FINDINGS

Temperature

During both visits to the study area, Confederation Lake was thermally stratified (see Tables 1 and 2). On June 17, #4 and #6 were sampled at ten foot intervals and #6 and #9 were sampled in this manner on July 14. At station 4, the surface to bottom change in temperature was 25^{O}F and a well defined thermocline was present between the 10- and 20-foot levels. On both sampling dates, station 6 had a

$15^{\circ}F$ change in temperature from top to bottom and the thermocline occurred below the 20 foot level. Station 9 had a weakly defined thermocline somewhere between the 20- and 40-foot levels and a drop of $19^{\circ}F$ between the epilimnion and the hypolimnion.

Dissolved Oxygen

Tables 1 and 2 of the Appendix provide the respective oxygen concentration and saturation values in Confederation Lake on June 17 and July 14.

Disregarding the results from station 4 which are anomolous for nearly all parameters, the general condition in Confederation Lake on June 17 was good with respect to oxygen content. The minimum concentration (7 mg/l) and per cent saturation (64) occurred at a depth of 52 feet at station 7. By July 14, the oxygen supply of the hypolimnetic waters of Confederation Lake had been seriously reduced so that the minimum oxygen concentration and per cent saturation values, which again occurred at station 7, were 4 mg/l and 36 per cent, respectively. The lack of hypolimnetic oxygen stability suggests that Confederation Lake is slightly mesotrophic.

Water Quality

Tables 3 and 4 of the Appendix give the results of detailed chemical analyses of water samples taken from Confederation Lake on June 17 and July 14.

In general, the concentration of all chemical constituents, pH excluded, can be considered as very low and of the same magnitude as found in most oliogtrophic and mesotrophic lakes in Northwestern Ontario.

The low dissolved solids, heavy metals and alkalinity values present in Confederation Lake demonstrate the extreme vulnerability of this lake's ecosystem should mining wastes be discharged to it. This is most apparent if one considers that the extremely low alkalinity and dissolved solids content of Confederation Lake means that these waters have little or no capacity to buffer pH should hydrogen ions be generated from the oxidation of sulphuritic mining wastes. The waters of Confederation Lake have a natural pH which falls on the acidic side of neutrality.

Phytoplankton

Ten samples taken from Confederation Lake on July 14 were analyzed to determine the standing crop of phytoplankton. These results appear in Table 5 of the Appendix.

In general, the total a.s.u. (areal standard unit) values for all stations can be considered as extremely low. Station 2, with a total a.s.u. value of 190 was the lowest while stations 4 and 8 were highest with counts of 683 and 646 a.s.u/ml, respectively. The station to station variations in a.s.u. values probably reflect differences in lake morphometry and not changes in water quality.

Species composition throughout Confederation Lake was similar with a wide distribution of the taxa over the four major groups of phytoplankton. The blue-greens dominated, the diatoms and flagellates sub-dominated while the greens were represented by only a few species. *Chroococcus*, a colonial blue-green, was dominant in most samples. *Aphanizomenon*, *Anabaena* and *Oscillatoria* occurred frequently but in lesser numbers. The flagellated algae were well represented being dominated by *Dinobryon sertularia*, *D. bavaricum*, *Cryptomonas erosa*, *Chlamydomonas* spp. and low numbers of *Synura uvella.* The diatoms were represented by *Rhizosolenia eriensis*, *Synedra* spp. at all locations. *Melosira*, *Asterionella* and *Tabellaria* occurred at most stations in low numbers.

On the basis of a single set of samples which revealed low numbers and a large variety of phytoplankton slightly dominated by blue-greens, it would appear that Confederation Lake is on the border between oligotrophy and mesotrophy.

Bottom Fauna

Table 6 of the Appendix gives the results of bottom fauna sampling carried out at ten locations on Confederation Lake on July 14.

As in most lakes, the data show a strong relationship between water depth and the distribution of bottom fauna. A total of nineteen taxa of macro-invertebrates were taken from the lake. All of these forms were represented at the shallow-water near-shore stations (i.e. 6 and 10) whereas only seven of the nineteen taxa were present at the deep open-water stations.

Two species taken from the open-water stations, the amphipods *Pontoporeia affinis* and the opposum shrimp *Mysis relicta* have special significance as indicator organisms since both of these taxa are indigenous to the clean-water oligotrophic and mesotrophic lakes of Northwestern Ontario.

Stations 6 and 10, which are important monitoring sites because of their location relative to the possible point of wastes discharge to Confederation Lake, had typical shallow water associations of bottom fauna characterized by a low number of individuals (i.e. standing crop) and a large variety of taxa (i.e. diversity). Taxa which dominated these shallow water stations were mayflies of the genus Hexagenia and Ephemera, midges of the family Tendipedidae, amphipods of the species Hyalella azteca and Pontoporeia affinis, clams of the genus Pisidium, snails of the genus Amnicola and sludgeworm of the family Tubificidae.

Fish

During July, 1970, the Ontario Department of Lands and Forests conducted a minimal fisheries inventory of Confederation Lake using beach seines and gill nets. The findings of the survey revealed the presence in Confederation Lake the following species of fish: lake trout, Salvelinus namaycush; northern pike, Esox lucius; lake whitefish, Coregonus clupeaformis; lake herring, Coregonus artedii; white sucker, Catostomus commersoni; fathead minnow, Pimephales promelas; yellow perch, Perca flavescens; pearl dace, Semotilus margarita; brook stickleback, Culaea inconstans; ninespin stickleback, Pungitius pungitius; spoonhead sculpin, Cottus ricei; trout perch, Percopsis omiscomaycus; johnny darter, Etheostoma nigrum; and logperch, Percina caprodes. Walleye and lake trout have been stocked into Confederation Lake.

RECOMMENDED CRITERIA

In July of 1970, the OWRC released its 'Guidelines and Criteria for Water Quality Management in Ontario'. In keeping with the intent of the policies contained therein, the development of mining operations in the vicinity of Confederation Lake must be consistent with the protection of water quality suitable for multiple use.

Past experience has clearly indicated the extreme vulnerability of poorly buffered waters to reduced pH, increases in toxic metal concentrations and substantial increases in dissolved solids content. The failure of initial pH adjustment to prevent permanent mitigation of pH effects has underlined the necessity to ensure complete oxidation of sulphuritic materials prior to discharge. In a number of situations, acid generation in the receiving water has resulted from the continued oxidation of sulphides and other compounds present in mining wastes.

Adequate maintenance of the existing high quality in Confederation Lake necessitates application of the following pertinent water quality criteria at a selected monitoring site or sites.

Criteria	Value (calculated 'no effect' levels)
pH*	6.5 to 8.5 (precise value to be determined)
Copper	.0015 mg/l
Iron	.5 mg/l
Lead	.02 mg/l
Manganese	1 mg/l
Nickel	.08 mg/l
Zinc	.02 mg/l
Mercury	.005 mg/l
Cadmium	.005 mg/l

*Adequate controls of acidic discharges or substances having a latent potential to cause subsequent pH depression in the receiving water system must be maintained.

The aforementioned criteria are calculated 'no effect' levels based on extrapolation of available literature dealing with experimental evaluations of acute and, in some cases, sub-lethal effects of the various wastes on aquatic organisms.

The values cited for zinc and copper, .02 mg/l and .0015 mg/l, respectively are derived from a generous accumulation of acute toxicity results under well-defined conditions and supported by experimental assessments of sub-lethal effects including reproductive effects and appropriate measures of physiological or behavioral alterations. Pertinent literature supporting the criteria for zinc and copper include recent work reported by Brungs (1969), Arthur (1970), Mount (1968), Saunders et. al. (1967) and Brown et. al. (1970).

The values cited for iron, lead, manganese and nickel are based on results of acute toxicity tests but so far sub-lethal effects have not been adequately defined. An appropriate safety factor has thus been applied and incorporated into the values assigned, based on a consideration of factors such as stability and synergistic potential of the element under consideration. Reference to studies reported by Brown et. al. (1970) dealing with the acute toxicity of nickel, and Water Quality Criteria (1963) which provides a summary of acute toxicity figures for manganese, iron and lead provide the pertinent sources from which the values in the above table were derived.

Mercury and cadmium are metals which are known to accumulate through the aquatic food chain and which may be problematical where man is the terminal predator. The potential health hazard associated with these two metals necessitates the stringent values given in the foregoing table.

In order to meet these somewhat stringent requirements considering the poor buffering capacity of Confederation Lake, maximum possible reuse of process water appears to be necessary.

Also, in order to assure the future protection of the lake, should a discharge be unavoidable, a consideration of loading volumes for the various waste constituents relative to the volume of South Bay (the receiving portion of Confederation Lake) and Confederation Lake proper is essential. In addition, water retention times in Confederation Lake should be assessed in light of waste loading forecasts. Such an evaluation would permit an estimation of the accumulating potential of conservative metals and dissolved solids which, in turn, would govern the length of time that such wastes could be discharged.

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TABLE 1

Physico-Chemical Data, Confederation Lake, June 17, 1970

Station	Depth ft.	Secchi Disc ft.	Conductivity (micromhos/cm)	Temp °F	Dissolved oxygen (ppm)	Oxygen Saturation (%)
1	0	12	42.5	67	8	90
	30		32.5	49	8	72
2	0	12	42.5	68	8	91
	30		36.0	54	7	67
3	5	5	44.0	70	8	92
4	0	10	45.0	72	9	100+
	10		44.0	66	9	99
	20		35.0	50	6	55
	30		36.0	47	3	26
5	0	10	44.0	68	9	100+
	48		39.0	52	9	84
6	0	12	45.0	70	9	100+
	10		45.0	69	9	100+
	20		44.0	67	8	90
	28		40.0	55	8	77
7	0	10	44.0	70	9	100+
	52		35.0	51	7	64
8	0	10	45.0	69	9	100+
	50		35.0	48	9	80
9	0	10	45.0	69	9	100+
	72		35.0	50	9	82

TABLE 2

Physico-Chemical Data, Confederation Lake, July 14, 1970

Station	Depth Ft.	Secchi Disc. Ft.	pH	Conductivity (Micromhos/cm)	Temp. °F	Oxygen	
						Dissolved (ppm)	Saturation (%)
2	0	14	6.3	50.0	73	8	95
	34		6.7	37.5	50	4	36
3	4	4	6.6	48.5	74	8	96
4	0	14	6.5	47.5	74	8	96
	30		6.8	40.0	48	1	0.9
5	0	16	6.2	47.5	73	8	95
	42		6.8	37.5	52	4	
6	0	16	6.6	47.5	73	8	95
	10		6.9	47.5	72	8	94
	20		6.9	43.0	67	8	90
	30		6.9	40.0	57	8	80
7	0	15	6.6	45.0	70	7	80
	50		6.7	37.5	50	4	36
8	0	15	7.0	46.0	70	7	80
	55		7.0	40.0	50	5	45
9	0	15	6.9	46.0	70	8	92
	10		6.8	46.0	70	8	92
	20		6.8	42.5	67	7	78
	30		6.8	40.0	60	7	72
	40		7.0	36.0	53	6	57
	50		7.0	35.0	52	6	56
	60		7.0	35.0	51	6	55
10	4	4	6.7	46.0	71	8	94
11	0	15	6.7	46.0	71	7	82
	35		6.7	40.0	64	7	76
12	0	16	6.7	47.5	72	8	95
	70		7.0	35.0	50	6	55

TABLE 3

RESULTS OF CHEMICAL DETERMINATIONS MADE ON WATER SAMPLES COLLECTED FROM CONFEDERATION LAKE ON JUNE 17, 1970. ALL VALUES EXCEPT pH AND TURBIDITY ARE REPORTED AS PARTS PER MILLION

Station / Parameter	1		2		3	4				5	
	T	B	T	B	B	0'	10'	20'	30'	T	B
Total solids	46	48	78	50	70	78	56	72	76	68	50
Susp. solids	1	1	1	2	1	1	1	1	2	1	1
Diss. solids	45	47	77	48	69	77	55	71	74	67	49
Turbidity	1.2	1.0	0.9	1.3	0.7	1.0	1.2	1.3	2.2	.8	.7
Sulphates	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Free ammonia	.07	.07	.05	.02	.07	.05	.04	.05	.11	.02	.06
Total Kjeldahl	.42	.36	.37	.28	.36	.35	.34	.33	.42	.24	.35
Nitrite	.002	.003	.002	.002	.003	.003	.002	.003	.003	.002	.002
Nitrate	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	.00
Total phosphorus	.012	.015	.015	.019	.014	.011	.011	.012	.07	.053	.038
Alkalinity	19	19	17	19	17	17	19	19	19	19	19
Acidity	2	4	2	4	3	3	2	4	6	2	4
pH	6.5	6.5	6.5	6.5	6.6	6.7	6.7	6.7	6.7	6.8	6.8
Iron	.10	.15	.30	.30	.10	.15	.15	.40	.60	.15	.45
Zinc	.04	.02	.03	.03	.02	.03	.03	.02	.04	.00	.02
Copper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium	1	1	1	1	1	1	1	1	1	1	1
Potassium	.6	.6	.6	.6	.6	.6	.6	.6	.6	.7	.6
Calcium	10	8	8	9	9	9	9	9	9	8	8
Magnesium	1	1	1	1	1	1	1	1	1	1	1

Note: T = Surface Water

B = Bottom Water

..... 2

TABLE 3

RESULTS OF CHEMICAL DETERMINATIONS MADE ON WATER SAMPLES COLLECTED FROM CONFEDERATION LAKE ON JUNE 17, 1970. ALL VALUES EXCEPT pH AND TURBIDITY ARE REPORTED AS PARTS PER MILLION

Station / Parameter	6				7		8		9	
	0'	10'	20'	30'	T	B	T	B	T	B
Total solids	64	54	56	76	68	78	50	56	48	48
Susp. solids	1	1	1	1	1	3	1	2	1	1
Diss. solids	63	53	55	75	67	75	49	54	47	47
Turbidity	.9	.7	.7	.7	.9	.8	.5	.9	.8	1.4
Sulphates	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Free ammonia	.07	.05	.06	.02	.02	.02	.04	.02	.06	.01
Total kjeldahl	.28	.29	.29	.28	.34	.33	.20	.24	.22	.30
Nitrite	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002
Nitrate	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Total phosphorus	.006	.007	.012	.007	.008	.017	.006	.12	.010	.001
Alkalinity	19	19	19	19	19	19	19	19	19	19
Acidity	2	2	2	3	2	4	2	3	2	3
pH	6.9	6.9	7.0	7.0	7.0	7.0	7.1	7.1	7.1	7.1
Iron	.10	.15	.40	.20	.15	.10	.10	.35	.10	.15
Zinc	.00	.02	.02	.03	.03	.00	.00	.00	.02	.01
Copper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium	1	1	1	1	1	1	1	1	1	1
Potassium	.7	.6	.7	.6	.6	.6	.7	.6	.6	.7
Calcium	8	9	8	9	9	9	9	9	9	9
Magnesium	1	1	1	1	1	1	1	1	1	1

Note: T = Surface Water
B = Bottom Water

TABLE 4

RESULTS OF CHEMICAL DETERMINATIONS MADE ON WATER SAMPLES COLLECTED FROM CONFEDERATION LAKE ON JULY 14, 1970. ALL VALUES EXCEPT pH AND TURBIDITY ARE REPORTED AS PARTS PER MILLION

Station	2		4		5		6				7	
Parameter	T	B	T	B	T	B	0'	10'	20'	30'	T	B
Total solids	60	70	50	52	48	48	52	36	54	52	58	50
Susp. solids	1	1	1	3	1	1	1	1	1	1	1	1
Diss. solids	59	69	49	49	47	47	51	35	53	51	57	49
Turbidity	.6	.5	.6	5.6	.4	.5	.6	.9	.8	1.0	.6	.8
Sulphates	<5	<5	<5	7	<5	<5	<5	<5	6	<5	<5	<5
Free ammonia	.02	.02	.00	.11	.01	.00	.00	.02	.02	.01	.00	.02
Total kjeldahl	.25	.24	.52	.55	.21	.19	.25	.42	.31	.25	.21	.23
Nitrite	.004	.003	.002	.005	.002	.001	.001	.001	.001	.001	.002	.006
Nitrate	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02
Total phosphorus	.01	.017	.009	.049	.006	.005	.013	.010	.013	.010	.009	.016
Alkalinity	19	19	19	25	19	19	21	19	21	21	21	21
Acidity	2	6	2	8	2	4	4	2	2	4	2	7
pH	6.1	6.1	6.2	6.3	6.4	6.4	6.5	6.5	6.6	6.6	6.6	6.6
Iron	.05	.20	.10	.80	.05	.05	.05	.10	.15	.10	.10	.15
Zinc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium	1	1	1	1	1	1	1	1	1	1	1	1
Potassium	.7	.7	.7	.7	.7	.6	.7	.7	.5	.8	.8	.7
Calcium	7	7	7	7	7	7	7	7	7	7	7	7
Magnesium	3	3	3	3	3	3	3	3	3	3	3	3

Note: T = Surface Water

B = Bottom Water

TABLE 4

RESULTS OF CHEMICAL DETERMINATIONS MADE ON WATER SAMPLES COLLECTED FROM CONFEDERATION LAKE ON JULY 14, 1970. ALL VALUES EXCEPT pH AND TURBIDITY ARE REPORTED AS PARTS PER MILLION

Station / Parameter	8		9							11		12	
	T	B	0'	10'	20'	30'	40'	50'	60'	T	B	T	B
Total solids	58	42	40	46	60	44	60	42	48	60	58	52	50
Susp. solids	1	1	1	1	1	1	1	1	1	1	1	1	1
Diss. solids	57	41	39	45	59	43	59	41	47	59	57	51	49
Turbidity	.5	.7	.5	.5	.5	.5	.4	.5	.6	.5	.6	.4	1.5
Sulphates	5	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Free ammonia	.00	.00	.00	.02	.00	.01	.00	.00	.00	.00	.00	.00	.03
Total kjeldahl	.30	.21	.35	.21	.19	.24	.35	.19	.33	.26	.23	.20	.30
Nitrite	.002	.001	.002	.002	.001	.001	.001	.001	.001	.002	.002	.001	.002
Nitrate	.00	.01	.00	.00	.00	.00	.01	.01	.01	.00	.00	.00	.01
Total phosphorus	.012	.005	.014	.004	.008	.010	.004	.008	.007	.007	.007	.007	.007
Alkalinity	21	19	21	19	19	19	20	20	19	19	19	19	19
Acidity	2	5	2	2	2	3	3	3	3	2	2	2	2
pH	6.6	6.6	6.6	6.6	6.7	6.7	6.7	6.7	6.6	6.7	6.7	6.7	6.7
Iron	.05	.10	.05	.10	.10	.10	.10	.05	.10	.05	.10	.10	.10
Zinc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium	1	1	1	1	1	1	1	1	1	1	1	1	1
Potassium	.7	.9	.8	.8	.8	.9	.8	.7	.8	.7	.7	.7	.6
Calcium	7	7	7	7	7	7	7	7	7	7	7	7	7
Magnesium	3	3	3	3	3	3	3	3	3	3	3	3	3

Note: T = Surface Water
B = Bottom Water

TABLE 5

Composition and abundance of phytoplankton collected from Confederation Lake on July 14, 1970. Results are expressed in areal standard units (a.s.u.) per millilitre.

Taxa \ Station	2	4	5	6	7	8	9	10	11	12
BLUE GREEN										
Anabaena	2	8	2	3	1	4	2	3	4	5
Anacystis	6		4	1	135	78	40		7	
Aphanizomenon	39	28	5	8		15	9		6	9
Chroococcus	23	258	127	33	92	293	132	89	249	36
Gomphosphaeria	2		1							
Lyngbya		118			2					
Oscillatoria	15	70	16		2	2	7	2	5	11
Spirulina princeps		10								
Agmenellum			1	1		2	2	3	1	1
Dactylococcopsis			4			P	3	3		
FLAGELLATES										
Chlamydomonas	5	6	5	17	28	14	16	31	25	15
Cryptomonas erosa	3	10	3	2	12	9	4	13	6	1
Dinobryon sertularia	21	43	8	5	37	147	14	42	20	126
Dinobryon bavaricum	3		8	12	4	5	8	14	7	
Peridinium	4	11						17	12	
Synura uvella	3		1	2	3	4	8		2	
Glenodinium			1			6				
Mallomonas		4								
Euglena		21					10			
Lepocinclis			1							
Ceratium										32
GREENS										
Ankistrodesmus	5	7	2	2	2	2	5	1	2	2
Staurastrum			4							
Quadrigula	2									
Crucigenia	1							2	2	
Closteriopsis		6								
Cosmarium										3

Continued ....

TABLE 5 - Cont.

Station Taxa	2	4	5	6	7	8	9	10	11	12
DIATOMS										
Asterionella formosa			16	47	44	26	10	16	56	89
Cyclotella	6	12	7	2	1	5	5	6	11	8
Fragilaria crotonensis				7		P		30	9	27
Melosira	16	15	5	14	11				37	1
Navicula								3		
Stephanodiscus			3							
Synedra	19	3	12	14	1	9	12	2	2	21
Tabellaria			1	16	36	21	13	13	12	36
Rhizosolenia eriensis	15	53	3	23	13	3	36	8	2	27
Total a.s.u. per ml	190	683	240	209	424	646	336	298	477	450

TABLE 6

BOTTOM FAUNA DATA SECURED FROM TEN LOCATIONS ON CONFEDERATION LAKE

JULY 14, 1970 - RESULTS EXPRESSED IN NUMBER OF ORGANISMS PER SQUARE FOOT

	CONFEDERATION LAKE									
Taxa Station	2	4	5	6	7	8	9	10	11	12
MAYFLIES										
Ephemera				<1				<1		
Hexagenia				4	<1			10	2	
CADDISFLIES										
Oecitis				<1						
Phylocentropus								<1		
Leptoceridae				<1						
DRAGONFLY										
Gomphidae								<1		
ALDERFLY										
Sialis				<1				<1		
DIPTERA										
Tendipedidae	6	28	3	10	5	17	6	10	4	4
Heleinae				<1				2		
Chaoborus	31	1	22	16	19	30	13		4	8
OPOSSUM SHRIMP										
Mysis relicta				<1	<1	<1	<1			<1
BEETLE										
Gyrinus								<1		
AMPHIPOD										
Hyalella azteca								3		
Pontoporeia affinis			50	18	23	19	28		7	22
CLAM										
Pisidium				1	<1	2	2	3	<1	2
SNAIL										
Amnicola				<1				5		
LEECH										
Piscicolidae								<1		
TRICLAD										
Dugesia								<1		
SLUDGEWORM										
Oligochaeta	2		<1	<1	1	<1	<1	2		2
Total Taxa	3	2	4	13	7	6	6	14	5	6

(9480)
MOE/KEN/WAT/ANTO

MOE/KEN/WAT/ANTO
German, M.J.
Water quality
evaluation of Confederation anto
Lake District of Kenora
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